PATHOPHYSIOLOGICAL CHANGES IN BED REST

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16. Abstract The author is highly critical of the lack of discrimination shown by doctors in ordering bed rest for their patients. He draws upon the published experiences by the Romanian surgeon Liviu Campeanu and the accounts of the first surviving heart transplant patients in order to point out the very positive effects one may expect from getting a patient on his feet as quickly as possible. Among the many serious consequences of extended bed rest, the author particularly emphasizes the declive edemas caused when a reduction in muscle mass is accompanied by a relative increase of "free", gravitation-susceptible fluid in the interstitial fluid space, and he cites the dangers to the respiratory and renal systems caused by gravitational pull on the supine system.

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"The bed is the most dangerous weapon in a doctor's arsenal," /478* said S. B. Laache more than 50 years ago. Illness and bed rest are still almost synonymous concepts. Hospitals are classified according to, among other things, how many beds they have, and we talk of the number of days spent in bed rest rather than the number of days spent in treatment. All the same, we must admit that modern medicine generally speaking has an unscientific attitude concerning bed rest as a means of treatment. For most illnesses we lack controlled investigations of the effectiveness of bed rest as a means of treatment. One of the most important questions we can ask ourselves by the bedside of an ill person is, "Why is this particular patient in bed?" It ought to be possible to formulate clear indications for bed rest, as we do for most other forms of therapy. We have regulations for the use of medicines and for what constitute maximum doses for all potent medications. But we do not ask questions about the prescribing or maximal dose of our /479 most common means of treatment, the bed.

Man's physiological position after he has learned to stand on his legs is the upright position. Animals who have been hurt or just operated on scramble to their feet just as soon as they are able, and the same is true of sick children who have not yet been inculcated with the false teaching that the passive position on one's back is supposed to be beneficial for every kind of ailment. Looking at the problem in its historical perspective, it seems probable that the bed rest cures of earlier epochs in the treatment of tuberculosis carry some of the responsibility for our present misuse of the bed as a means of treatment. It is not

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* Numbers in the margin indicate pagination in the foreign text.

faith that moves mountains, it is doubt. Doubt as to whether bed rest is an indispensable and superior form of therapy was beginning to be heard 30-40 years ago. Especially surgeons began to mobilize patients who had just been operated upon, and they saw what then were considered amazingly good results in the form of a lower rate of postoperative morbidity (thromboses, lung complications) and shorter convalescence. Especially one of the "mobilizing pioneers" deserves to be remembered: the Romanian surgeon Liviu Campeanu. After many years of good experiences with postoperative mobilization even within the first 24-hour period after the operation, he created the concept "postoperative illness" or "the bed rest syndrome." "Postoperative Illness. A Reform of Surgical Procedures" is the title of the monograph he published in 1941, and which is also stimulating and useful reading today [3]. The book drowned in the maelstrom of events, because the warring nations were busy wiping out human lives, not reducing morbidity and shortening convalescence. But Campeanu's principles still constitute progressive medical practice. He operated primarily with local anesthesia, also when performing laparotomies. The great majority of his patients walked away from the operating table, they were allowed to sit down, but not to go to bed during the day. Members of the hospital staff, including doctors, who had to be operated on for appendicitis, hernia, etc., were back at work full-time either the day of the operation or the following day. Campeanu's statistics for postoperative thromboses, lung complications, wound infections and dehiscences were, and are, among the best in the world.

Heart transplants constitute a new conquest in medical territory in just the past year. This operation performed on patients with terminal heart failure is major surgery, not to say radical. If one studies the preoperative and postoperative status of the dentist Philip Blaiberg, it seems clear that without the most determined physiotherapy, which started within 5 hours after he

came out of surgery, he would never have been alive today [9]. Three days prior to the heart transplant, he had a life-threatening lung embolism, but there was no postoperative thrombosis or lung complication, and the healing of the surgical wound was perfect. As soon as he was able, he sat in a chair. He, who for months had been unable to get out of bed, could stand on his own legs 12 days after the operation. Denton Cooley, who, since May of 1968, has performed 24 heat transplants, recently published a progress report on the first six patient [4]. Of one of the patients, a 47-year-old man who for a whole year prior to the heart transplant had been a total invalid after repeated heart infarcts, it is reported that he could sit up without support after 36 hours, and that he was ambulatory after 48 hours. The human organism is a machine designed for work. It is a law of nature that organ systems which are not constantly stimulated through use, will weaken and atrophy.

1. Reduction of muscle strength is, both objectively and subjectively, the most obvious result of immobility.

2. The sense of weakness, dyspnea and dizziness, and the tachycardia and the orthostatic hypotension the patient gets the first time he gets up after an extended, passive bed rest, reflect the far-reaching changes in the cardio-circulatory function that result from immobility. The reduction in blood volume and the vasomotor instability are the main reasons for the symptoms. Also baroreceptors and volume receptors need daily "trim" to physiologically adjust the regional distribution of blood in the upright position. The same is true of the lymphatic pumping mechanism, which is a main factor in maintaining the normal negative pressure in the interstitial fluid space [7]. The lymphatic pump, drive by muscle contractions and arterial pulsations, together with osmosis, keeps the interstitial fluid space dry of "free fluid"; "free" or gravitation-induced movement of fluid is

maintained at a physiological minimum. These mechanisms are the reasons why healthy, ambulatory individuals awaken after a quiet night's sleep without declive edemas. There is no "free" interstitial fluid that gravity can influence; the physiological, interstitial fluid is a gravitation-resistant gel. Prolonged passive bed rest changes this physiological condition as well. With the reduction in muscle mass during immobility comes a relative increase of the interstitial fluid space, this time with "free" fluid susceptible to gravitation. Declive edemas can be found in practically all patients who have been immobile for an extended period, and ankle edemas as well as a heavy sensation in the lower extremities are the rule during the first period after the patient leaves the bed.

The renal angiotension II-aldosterone system is activated during the upright position. This is an important factor in the adjustment of the physiological vasomotor mechanism during upright position and work, and for the volume regulation of the extracellular space via renal blood filtering, reabsorption and excretion mechanisms [5].

3. The metabolic changes occasioned by passive bed rest can roughly be summarized as follows: a) a negative balance of nitrogen, calcium, phosphorus, magnesium and sulfur during reduction of the muscle mass, b) negative calcium-phosphorus balance with increased urine-calcium secretion due to increased osteolysis, disuse bone atrophy [8].

Hypercalcuria, together with stagnating filling of the pelvis during bed rest on the back disposes towards the formation of concretion. Stagnation in the pelvis increases the risk of flaring-up of latent pyelitis, or new infection due to transitory bacteriuria with intestinal microbes. This latter process is favored by constipation, which so frequently accompanies prolonged, passive bed rest.

4. The increased risk of thrombosis is discussed by Gjønnæss [6].

5. Probably the most dangerous component of the "bed rest syndrome," at least as far as old and elderly people are concerned, consists of the unfortunate consequences for lung ventilation and the secretion purifying of bronchial passages and windpipe. /480
In the prone position, the distribution of blood is altered so that the central (intrathoracic) blood volume increases compared to the upright position. The lungs are filled with blood in declive segments, and there is a significant reduction in vital capacity and maximum ventilation capacity. The most low-lying lung sections are hypoventilated. This can start a hypostatic-atelectatic bronchopneumonia which is no friend of the old, but rather their worst enemy. The stagnation of secretions in the bronchioles and bronchial tubes is a consequence of passive bed rest on one's back. The normal distribution of mucus around the entire circumference of the bronchial pipe during upright position is replaced by a declive stagnation of mucus when one is flat on one's back. The uppermost part of the pipe may be free of mucus and dry out. The cilia transportation of secretion then becomes ineffective, at the same time as the epithelium's resistance to infection decreases. Bronchiolitis-bronchitis easily develops into atelectasis-bronchopneumonia [2]. Effective coughing requires adequate muscles. The muscle atrophy that occurs during extended bed rest also attacks the diaphragm and the upper coughing muscles.

6. Pressure sores (a more correct name than bed sores) are a constant danger during passive bed rest, especially in the case of old or elderly patients. Also younger patients who are in a state of shock with significant hypotension for several hours (4-6 hours may be sufficient) may get deep-tissue necroses over the coccyx in to the facsia. This may also be true of fat patients, who are mistakenly assumed to have a protective layer of fat acting

as a bolster in this case. The locally compromised or suspended circulation -- pressure ischemia -- is just as destructive in fat patients.

Supposedly Indisputable Absolute Indications for (Passive) Bed Rest:

1. coma, regardless of cause
   commotio cerebri
   quadriplegia

2. debility, cachexia to such a degree that the patient is unable to sit, much less to be ambulatory

3. massive infections (encephalitis, meningitis, labyrinthitis, poliomyelitis, sepsis, peritonitis, acute hepatitis, pancreatitis, cholecystitis, entero-colitis, pneumonia, acute polyarthritis, spondylitis, osteomyelitis, cellulitis, acute thrombophlebitis, large abscesses, etc.)

4. considerable traumatic injuries:
   a. fractures
   b. contusions
   c. luxations (spinal column, hip joint, knee joint)
   d. extensive burns

5. shock
   a. cardiogenic
   b. hypovolemic
   c. septic

6. heart failure, general edemas

7. status asthmaticus, and other conditions requiring assistance in ventilation

8. painful conditions, especially in the skeletal-muscular system which can only be relieved by complete muscular relaxation;

9. postoperatively, though for as short a time as possible where there are no complications.

This list does not claim to be complete. As with any other form of therapy, the dose must be regulated according to the individual. The guideline must be that the patient should not spend one more day in bed than necessary for the prevention of injury or illness. If a patient wishes to get up, he should be permitted to do so unless there are indications towards the contrary. Our yet uncertain knowledge about the real, healing effects of bed rest in various types of illness makes us overly careful, perhaps to the detriment of our patients. Unnecessary bed rest can lead to apathy, depression and unhappiness and may lead the patient into a vicious circle. The bed must not become an instrument for iatrogenic diseases. In my opinion, we tend more often to underestimate than overestimate a patient's capacity to become mobile.

In the hospitals, more physiotherapists are needed for active mobilizing of the patients, both while in bed and during the first ambulatory phase of convalescence. Only those days of bed rest which are really indicated by the patient's condition may be considered effective days of treatment for our patients, both inside hospitals and without.

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